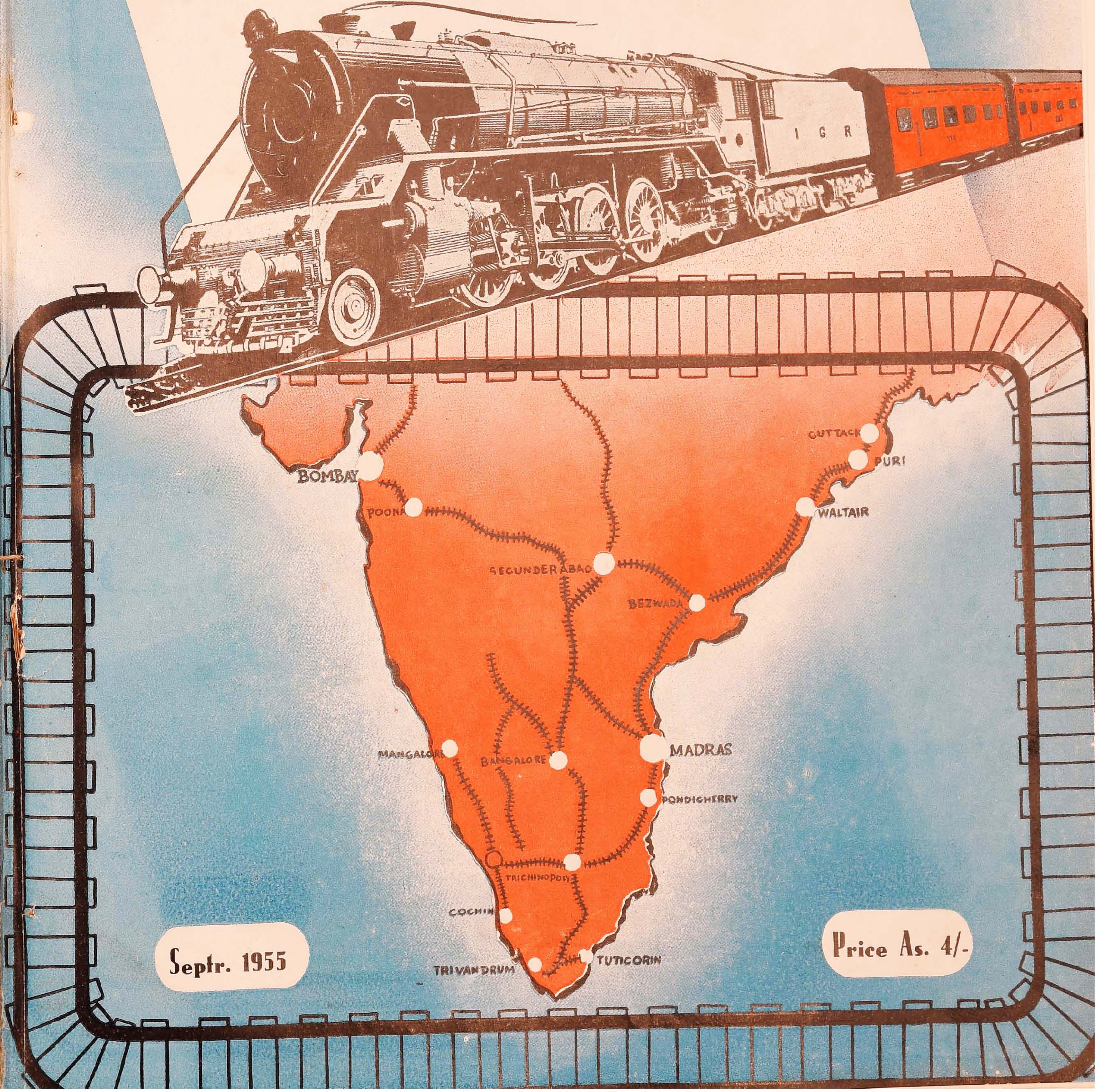
SOUTHERN RAILWAYS *Magazine*

OFFICE OF THE REGISTRAR OF BOOKS
27 SEP 1955
MADRAS



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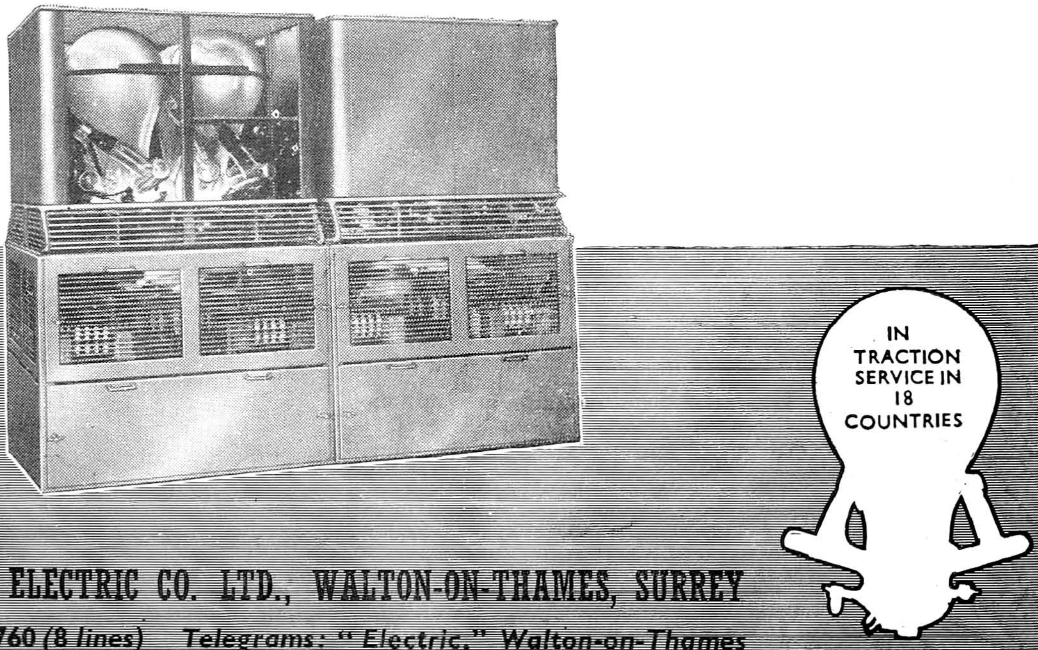

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(Inserted in the interests of Travelling Public by the Public Relations Officer, Southern Railways Magazine)

THE SEVERN TUNNEL

By Langton Gould-Marks

THE Severn Tunnel is the longest under-water railway tunnel in the world, yet it was over 66 years ago, in 1886, that the first passenger train went through it. It is four miles 620 yards long, with a total length of seven miles including the approach cuttings. It passes under the estuary of the Severn, which separates the County of Gloucestershire in England from Wales. It has the highest rise and fall of tide in Europe, its range being as much as 50 feet. There are also very powerful currents.

The project was begun in 1873. It took 13 years to build, because in 1879, when the two ends of the tunnel had been dug till they were only 130 yards apart, the miners struck a huge underground spring. The Welsh end was completely flooded in a few minutes and many of the workmen in the tunnel barely escaped with their lives. The job was temporarily abandoned.

After much individual courage by divers carrying out under water repairs, the work was resumed. On December 1, 1886, immence difficulties having been overcome, the first regular service through the tunnel was started.

The statistics of this undertaking are almost incredible for 76,400,000 bricks and 37,000 tons of cement were used. At the peak of the work no less than 3,628 men were on the pay roll. The tunnel goes down to 140 feet below the level of the track at either side of the river, and the top of the arch is 30 feet below the lowest point of the estuary.

60-YEAR-OLD ENGINES

The Great Spring and hundreds of other smaller ones flow into the tunnel, so pumping stations had to be erected. They pump up to 20 million gallons of water per day into the river. Two-thirds of the water comes from the Great Spring, and the clearing of this is done by the largest station, at Sudbrook on the Welsh side. The engines are steam operated and are the ones put in when the tunnel was built. They have been working ever since. The engines are beautiful. They are perfectly kept, with polished brass fittings and huge steel rods and valve gear. Gigantic rockers move the shafts, 200 feet long, up and down in the long dark pit going down to the bottom of the tunnel. There are 14 pumps at Sudbrook. The average stroke is 10 feet, and about 300 gallons of water is raised by each stroke. Four engines work at a time, resting the others for maintenance. These 60-year-old engines are so functional that to a layman they might well be out of the future and not out of the past.

At sudbrook also is the intake of the ventilating system. The air in the whole tunnel is circulated by a single fan 27 feet in diameter and nine feet across. This is worked by another equally aged, but just as efficient engine as the ones working in the pumps. The air in the tunnel is changed at the rate of 800,000 cubic feet per minute. There is no reserve fan, so it has to be kept working year in, year out.

Conditions in the tunnel increase the wear on rails to an amazing extent. Owing to foul air, moisture and chemical action, a rail which would do 20 years on a main line, then 20 years on a local line and possibly another 20 in a siding, has a life in the tunnel of barely five years. Therefore approximately two-and-a-half to three miles of track are renewed each year. To carry out this programme, some 400 tons of rails, 7,000 sleepers and 3,000 tons of ballast are required.

HARD WORK

About half-a-mile of track is changed each Sunday. Over 200 men are brought in from all over the Bristol Engineering Division. From some of the most distant points the trains start at 3. 0. a. m. The work is extremely hard and the hours long. All the labour is volunteer, and they are paid at Sunday rates from the time they get on the train until they get out at their home towns again.

When re-laying rails the worn ones are lifted out by hand and carted away. Fresh rails are dropped from a special train and are put into position. On alternate Sundays the ballast between the rails is removed, and the speed of the traffic is restricted until the new rails have been laid. The ballast used consists mainly of flint chips. Its purpose is to drain the track of surplus water. Owing to the conditions which destroy the rails, it becomes clogged very quickly with mud

and ceases to fulfil its function. After the new track has been put down special trucks drop the ballast between the rails, so that all that has to be done is to smooth it into position.

An inspection party from the Engineering Department weighs and measures individual rails at intervals along the tunnel. They are lifted up, weighed and then measured with callipers. If any undue wear is discovered a special investigation is carried out.

Another party, in specially constructed railway trucks with a super-structure to reach the roof, inspect and repair the brick-work. In this way every part of the tunnel is inspected, checked and repaired, if necessary, at regular intervals.

THE TELLTALE

To control movement in the tunnel and keep the normal maintenance staff in touch with either end, there are telephones at intervals along the walls. There is also a wire which runs the complete length of the tunnel supported by brackets from the wall; this is the telltale. If there is an emergency in the tunnel or some fault is discovered the wire is cut and an alarm bell rings at either end of the tunnel. This is the signal for complete stoppage of traffic.

The Post Office also maintain their cables, as their main lines from Bristol to Wales pass through the tunnel. In fact going through the tunnel on a maintenance Sunday one finds representatives of every service connected with the well-being of the tunnel working independently at their own particular jobs.

At five o'clock punctually the trains containing the workers and their equipment must be out of the tunnel and on their way to their home base. Nothing is left to chance, so a light engine is run through from either end to check up that everything is in order. When this is done the tunnel is open to traffic and it goes on giving perfect service under the strenuous tests of modern conditions.

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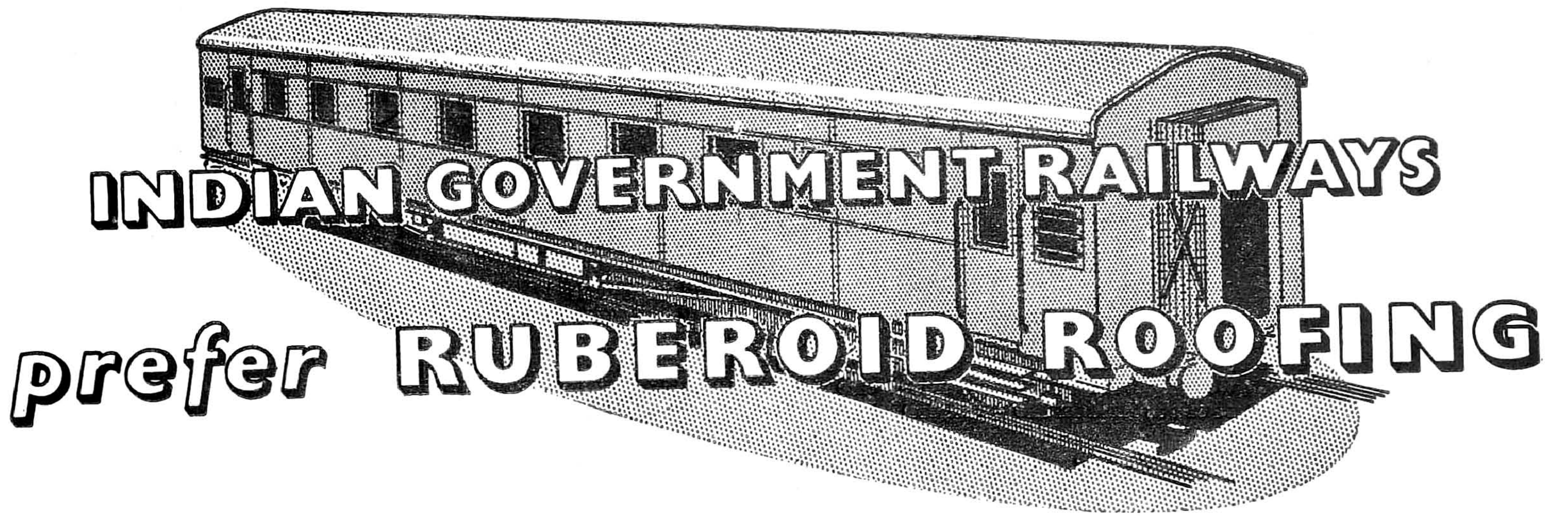

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The Role of BICC in Railway Electrification

THE initials BICC, familiar in every continent of the world, are frequently to be seen in those countries where schemes for industrial development and modernisation are progressing most rapidly. It is not possible to compute the many thousands of miles of telephone and power cables that have been manufactured and installed since the first branches of the Group were formed in 1882 nor would any useful purpose be served in enumerating the many overhead transmission line and trolley bus schemes successfully carried out. It is, however, not without review the part played by this Organisation in the modernisation of railway transport systems which has now become an essential feature of our economic life.

British Insulated Callender's Cables Limited, together with its subsidiary British Insulated Callender's Construction Company Limited, has been associated with railway electrification for forty three years, since the commencement of the electrification of the Melbourne suburban lines of the Victoria State Railways in 1912. This scheme was authorised to enable the railway company to cope with the ever growing traffic resulting from the rapidly increasing population of Melbourne during the years immediately preceeding the first World War. Since those early days many further railway electrification schemes have been successfully undertaken and commissioned in countries with climates varying from the sub-trophical conditions of Brazil, South Africa and India, through the more temperate weathers of Australia and Britain to the continental extremes of Poland. The underlying reasons which prompted the several authorities to pursue such progressive schemes were, of course, not identical in each case, although many of the benefits which are inherently derived from electrification were common to all. It may perhaps be advantageous to pause here and outline briefly why this should be so.

All countries for their transport systems require a prime source of power whether it be coal, oil or water and it is a fundamental measure of economy that where one or other of these sources of supply is non-existent or unduly expensive that emphasis should be placed on the full utilisation of the home produced or cheaper product. Certain countries, notably India, Central Africa,

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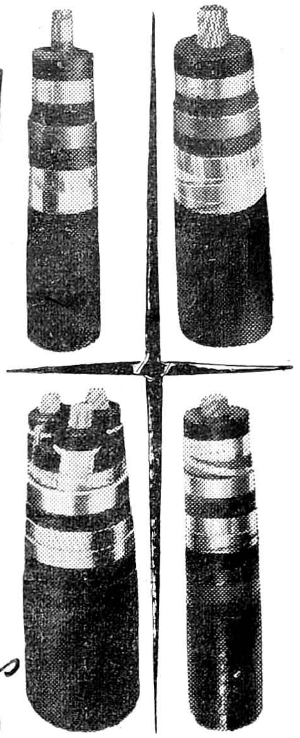
As the World's largest manufacturers of electric cables, BICC have had unrivalled experience in the development, manufacture and installation of cables for High Voltages — including Solid, Impregnated Pressure and Oil-filled types.

BICC were the first to develop a 3-core 132 kV Impregnated Pressure cable. A cable of this type recently installed in London for the British Electricity Authority, covers a ten mile route between Barking and Ilford. Two 3-core 0.6 sq. in. 132 kV cables, continuously rated at 120 MVA, were laid. A similar scheme—the first of its kind in the Southern Hemisphere—is at present being installed by BICC in Australia.

Many important Impregnated Pressure and Oil-filled cable contracts have been carried out by BICC over the voltage range 33 kV to 264 kV. In the 33 kV range we have introduced the use of aluminium sheathing for Impregnated Pressure cables—20 miles of this type having been commissioned during the last two years.

Meanwhile our research laboratories have developed 275 kV single-core cables, both Impregnated Pressure and Oil-filled, intended for use in conjunction with Great Britain's new super-Grid.



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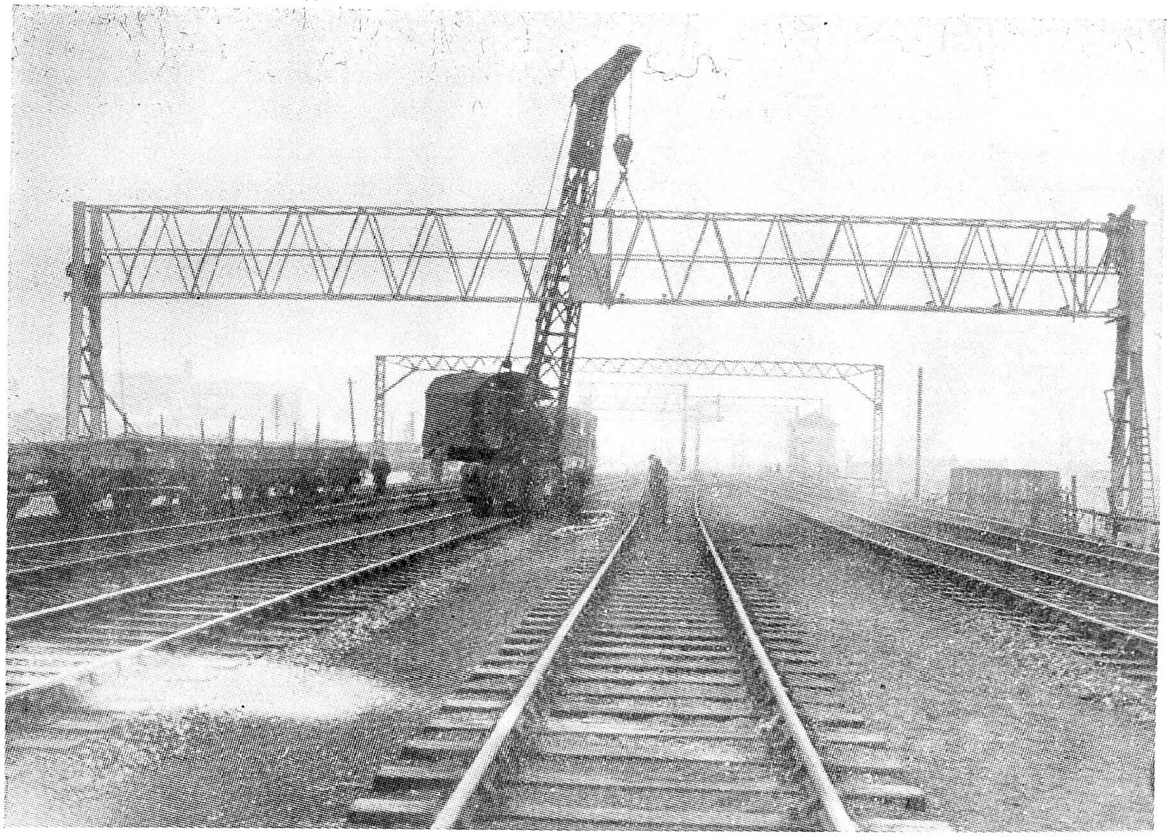
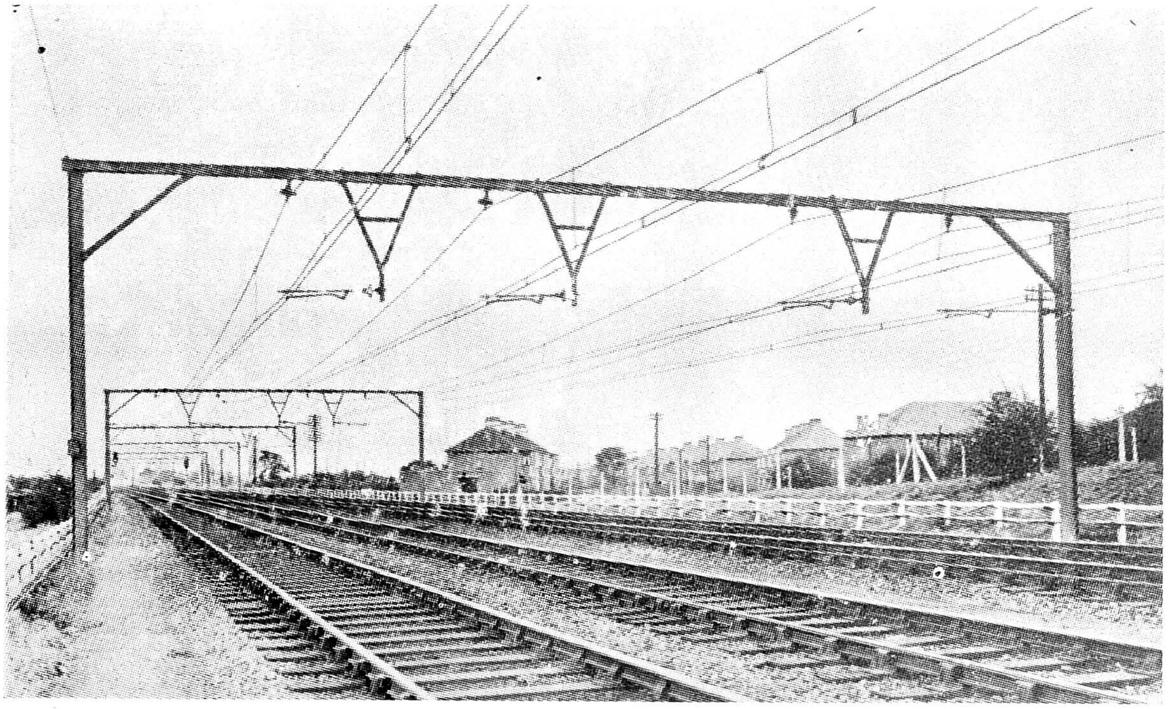


Erecting the bridge of a multi-track anchor structure—London to Shenfield Electrification.



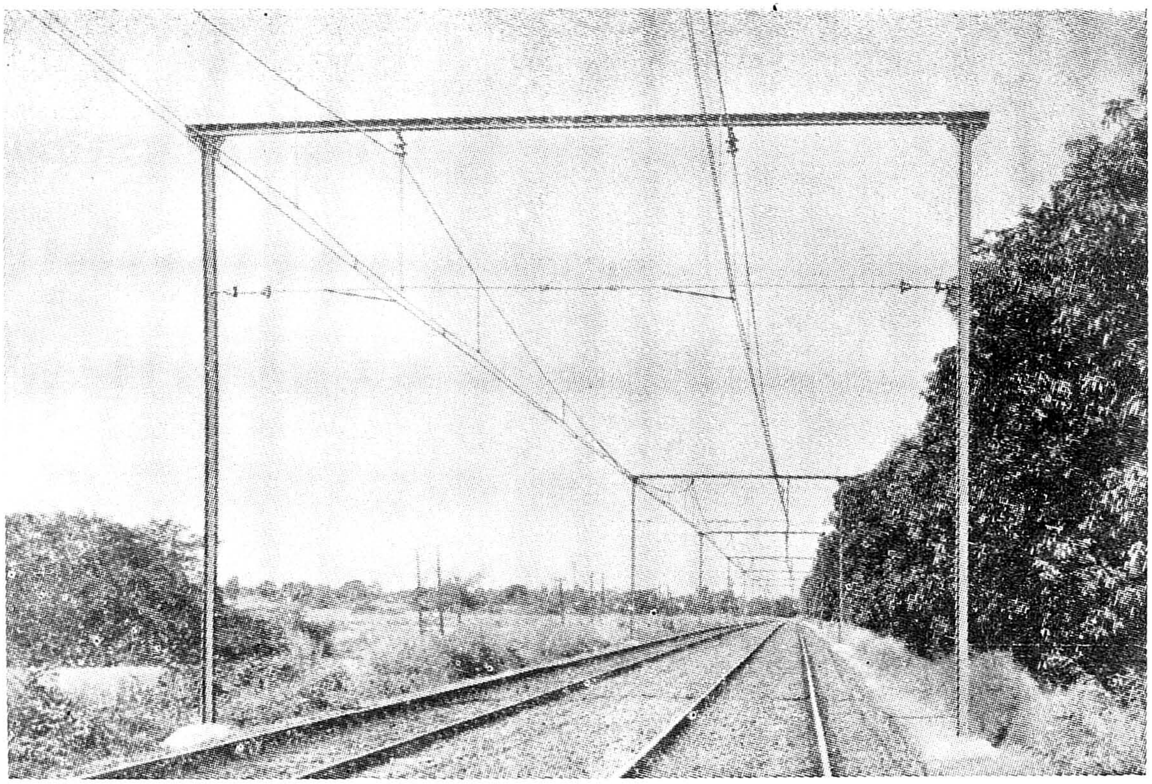
Four-track, broad flange beam portal structure. Showing a method of "registering" (i. e. locating) the contact wire and auxiliary catenary wire over each track. The wires are arranged in compound catenary form.—London to Shenfield Electrification.

New Zealand and others in Europe and Scandinavia are fortunate in possessing huge latent reserves of water power and it is therefore proper that these peoples should seek to derive the maximum benefit from the natural resources within their boundaries. For such reasons hydro-electric power stations have been planned and built to generate electricity to supply the industrial areas while at the same time the adoption of electric traction is projected in many cases to make use this readily available power.

It is also without dispute that the energy to be derived from coal or other indigenous fuels can be extracted through the medium of thermal power stations and converted to electrical energy with far greater efficiency than can be obtained by burning these fuels in steam locomotives. In addition, lower grades of fuel are normally consumed at power stations in contrast to the high quality coal required for steam traction.

Thus it may be said that conversion to electric traffic effects a considerable saving in the annual amount of fuel consumed. The efficiency of transmission and utilisation at the traction motors is extremely high, and the nature of the power demand at industrial off-peak hours enables the available generating plant to operate at a more uniform and therefore more economical loading.

From the operating viewpoint railway electrification provides advantages of similar magnitude. The availability of electric locomotives is very high because



Two-track construction on the Central Railway (ex-G. I. P. Railway, India).

Lattice-type supporting structure at Thana, Central Railway, India. Note the bird guards over the insulators to prevent accidental earthing of the overhead equipment.

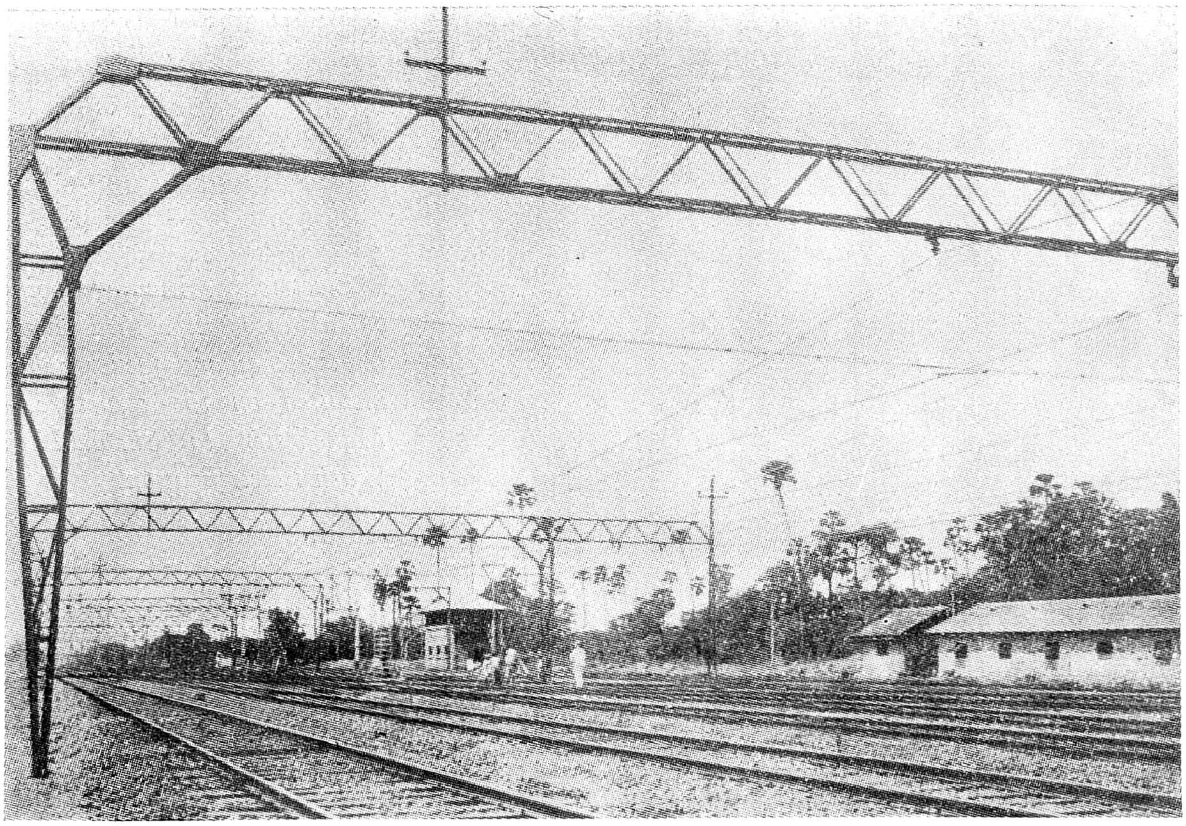
power is immediately on hand without the delays imposed by refuelling or refiring. Existing services may thus be operated with fewer locomotives, requiring a smaller maintenance staff together with the complete abolition of fuel storage facilities and turntables, leading to the simplification of sidings. Electrically propelled rolling stock has high rates of acceleration and deceleration permitting more punctual running and closer timings which enable (heavier and) more frequent trains to be handled over the existing tracks on faster schedules. Costly track duplication is thereby eliminated.

In the absence of smoke and soot associated with steam locomotives, the travelling public is presented with clean, fast and attractive rail transport which is unfailingly reflected in increased passenger traffic typified by two recent suburban schemes carried out by BICC in Britain. Today after 5 years of electric operation, the traffic on the London to Shenfield line is more than 100% higher than prior to electrification. On the Manchester–Glossop service after only 8 months, passenger traffic has increased by 142%.

Railway Electrification schemes are of necessity complex operations involving close co-operation between the several railway departments and contracting engineers to ensure the smooth flow of materials and an uninterrupted erection programme. It is at this stage that the wide manufacturing interests of the BICC Organisation and unrivalled skill of the construction staff offer to the railway the maximum advantage.

A detailed track survey must first be made to determine the types of foundation to be employed and siting of structures, places of electrical feeding and sectioning to mention but a little of information that must be carefully compiled. It is sometimes necessary to supplement existing track plans by aerial photography of sections of the route. With this knowledge to hand the structures which are to support or anchor the overhead contact systems are carefully designed while a parallel examination is made of the relevant electrical data including the power to be supplied over each section of the route, permissible voltage drop and the provision of protective devices. Particular attention is required at tunnels, stations and at road crossings where adequate electrical clearances are generally more difficult to obtain.

Operations on site begin with the selection of a suitable centre from which the field operations can be supervised and the necessary office and stores accommodation set up. From this depot foundation and steelwork trains convey the material to each track location at which experienced engineers control the excavation and placing of the foundations and the subsequent erection of the structures which are usually of steel in one of the many sections-channels, rods, broad flanged beams, rolled steel joists etc. When it is recalled that structures are sometimes required to span eight or more tracks it will be readily appreciated that any small errors in the placing of foundations may prove extremely costly during the steelwork erection. Here, too, close liaison with the railway operating department is vitally

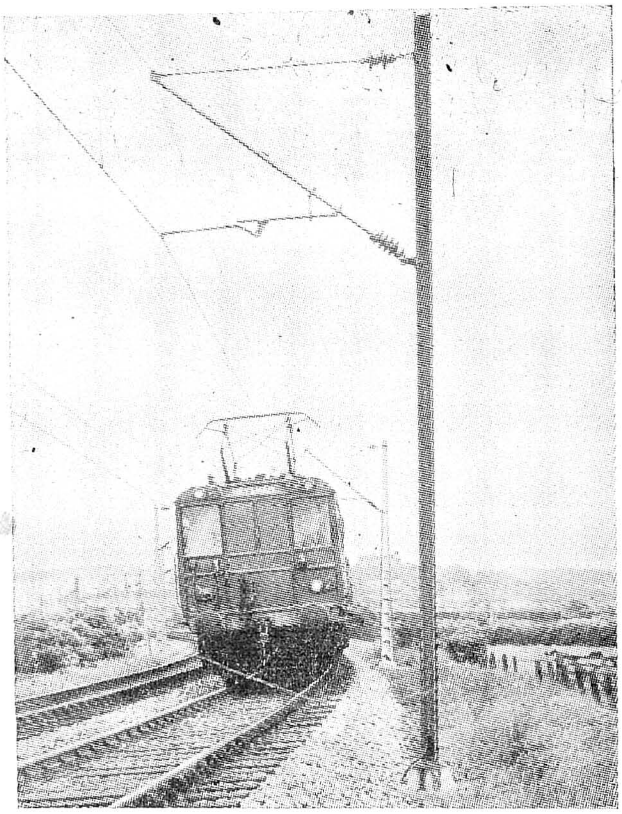


Long span lattice structures on the Western Railway (ex B.B. & C.I. Railway), India showing the structure extensions to carry transmission lines. The wires are arranged in simple catenary form.

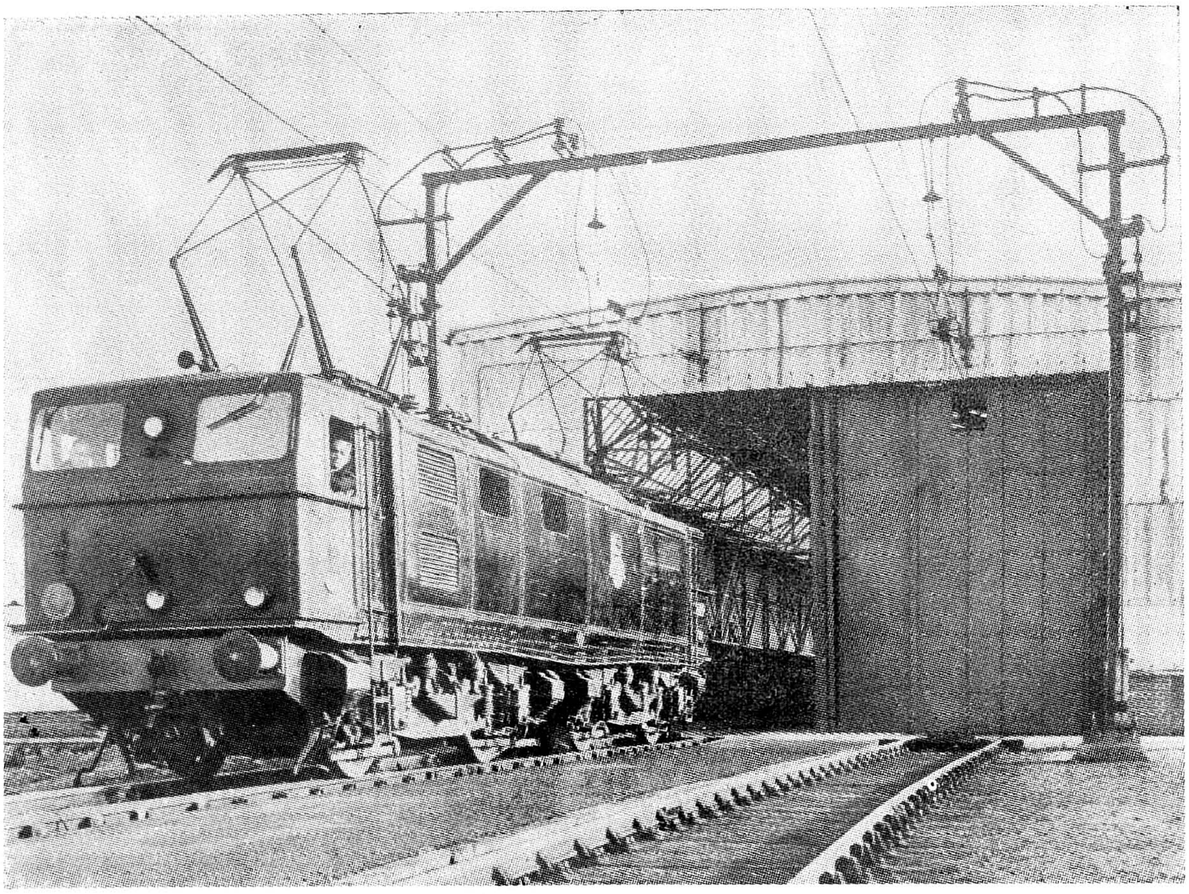
important to prevent delays to normal traffic; reference to some of the accompanying photographs will illustrate these remarks.

In due course, other construction trains, from which the overhead conductors are erected, begin operations under the surveillance of the wiring engineers. The conductors will usually be composed of one or two stranded wires per track which are suspended by insulators from the track structures in what is generally known as compound or simple catenary construction (See photographs). These wires form a flexible suspension system to carry the solid copper contact wire. Flexibility is essential to ensure sparkless current collection by the locomotive pantograph which must remain in sliding contact with the contact wire. For the same reason it is essential to avoid sharp changes of gradient of the contact wire during the planning stage and as these changes may also be self-introduced by seasonal changes in the conductor tensions it is sometimes desirable to arrange automatic tensioning devices (see photograph) whereby a constant mechanical tension may be maintained in the conductors throughout the complete temperature range.

Other site work includes the provision of feeder cables and switches by which the catenary system is energised from adjacent traction substations. These substations are frequently interconnected by overhead transmission lines are power cables and may be remotely controlled from a central supervisory centre for which purpose telecommunication cables are required. Special auxiliary power cables are also provided for the remote operation



Single track cantilever construction with steel and pre-stressed concrete structures. 6600 Volt alternating current electrification.—Lancaster to Morecambe & Heysham Railway.

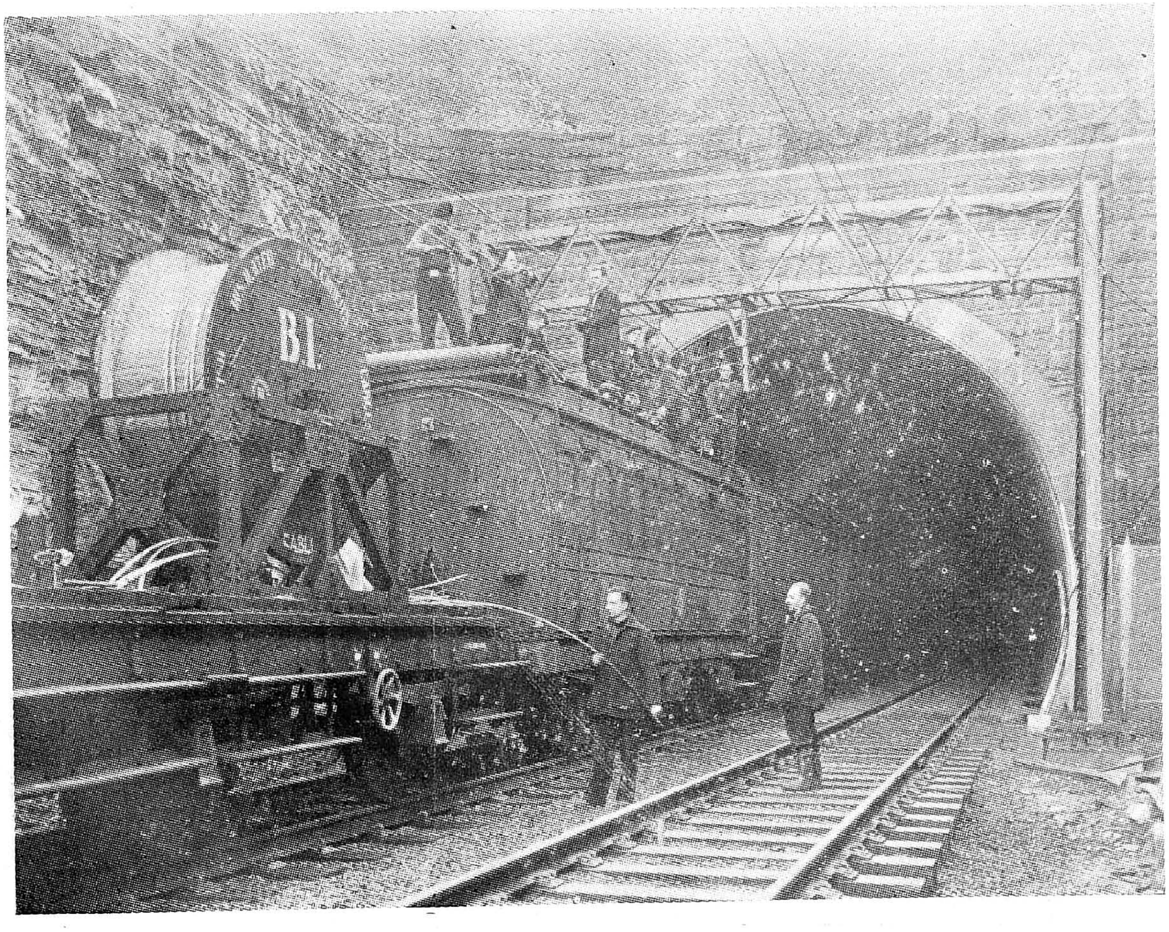


Electrical sectioning point outside locomotive shed showing switches and feeder cables mounted on the structure.—Manchester to Sheffield & Wath Electrification.

of signal and point motors. The joints between the ends of rails are usually electrically bonded to provide a conducting path for the return current and for safety reasons structure to rail bonds are fitted or else a continuous earthwire is used to connect all structures. These and numerous other essential features of a completed electrification scheme cannot be more than briefly described in an article of this length but it is hoped that the details mentioned will serve to enable the reader to appreciate more fully the overwhelming advantages of careful planning in design, manufacture, supply and erection which are made possible by many years of experience in this specialised field.

As recorded earlier the first complete railway electrification scheme pioneered by the BICC Group was in Australia where in addition to the conversion of 341 track miles to electric operation BICC also supplied 20,000 volts transmission mains linking the various traction substations to the Central Power House and telephone cables laid along the same route. In 1922 on behalf of South African Railways electrification of 300 track miles on the Natal Main Line between Pietermaritzburg and Glencoe was undertaken. This section was the most difficult to negotiate by steam traffic, as the route passes through the mountainous parts of the South African Tableland. It is also the main artery between the Natal Coalfields and the coast at Durban where there is a constantly increasing demand for bunker coal. Since electrification the daily gross tonnage hauled in the Glencoe-Durban direction has increased from 13,000 tons to 34,000 tons and the average travelling time in the reverse direction for passenger traffic has improved from $14\frac{1}{2}$ hours to 8 hours. On this scheme which was completed in thirtynine months some 1,000 miles of copper conductors and 7,000 tons of steel structures were used.

Electrification schemes in India commenced in 1923 with the Bombay Harbour Branch and local lines from Bombay to Thana comprising 160 track miles of equipment. This was followed by an extension from Thana to Kalyan and later extensions from Kalyan north eastwards to Igatpuri, and south eastwards to Poona with storage yards and goods sidings. Both these routes include a mountainous section and the equipments for the heavy gradients, tunnels and other special features demanded particular attention. In all 591 track miles of overhead equipment were erected together with 2.2 kV signal supply and 22 kV power supply lines. On the Kalyan to Poona section it was possible as a result of electrification to increase the gradient and remove the reversing station on the Bhore Ghat and so obtain through running. Smoke and fumes in tunnels which had been a source of great nuisance to the passengers were eliminated and considerable increases in train mileages and passenger traffic were obtained (e. g. the



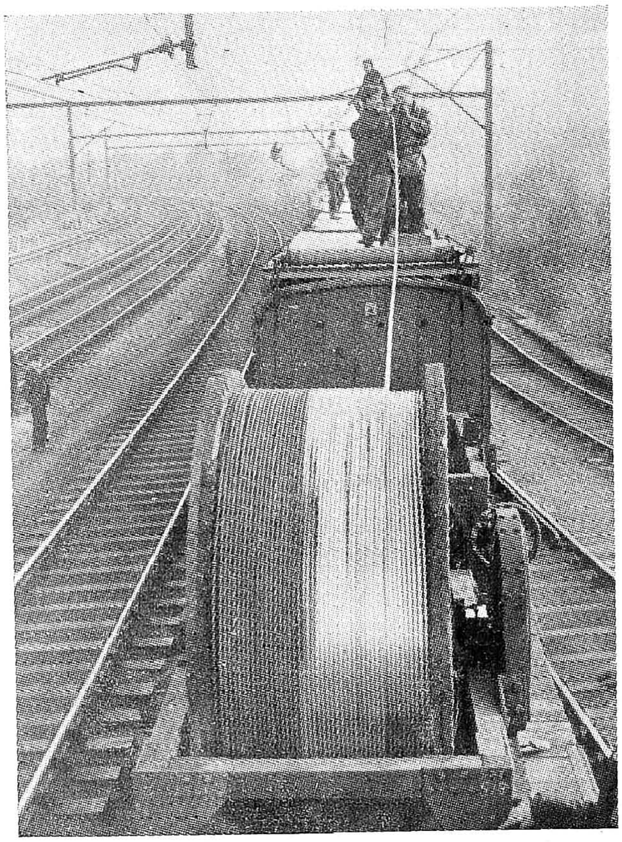
Adjusting the overhead equipment at the entrance to the New Woodhead Tunnel.—Manchester to Sheffield & Wath Electrification.

annual passenger traffic increased from 33 to 130 millions between 1929 and 1949).

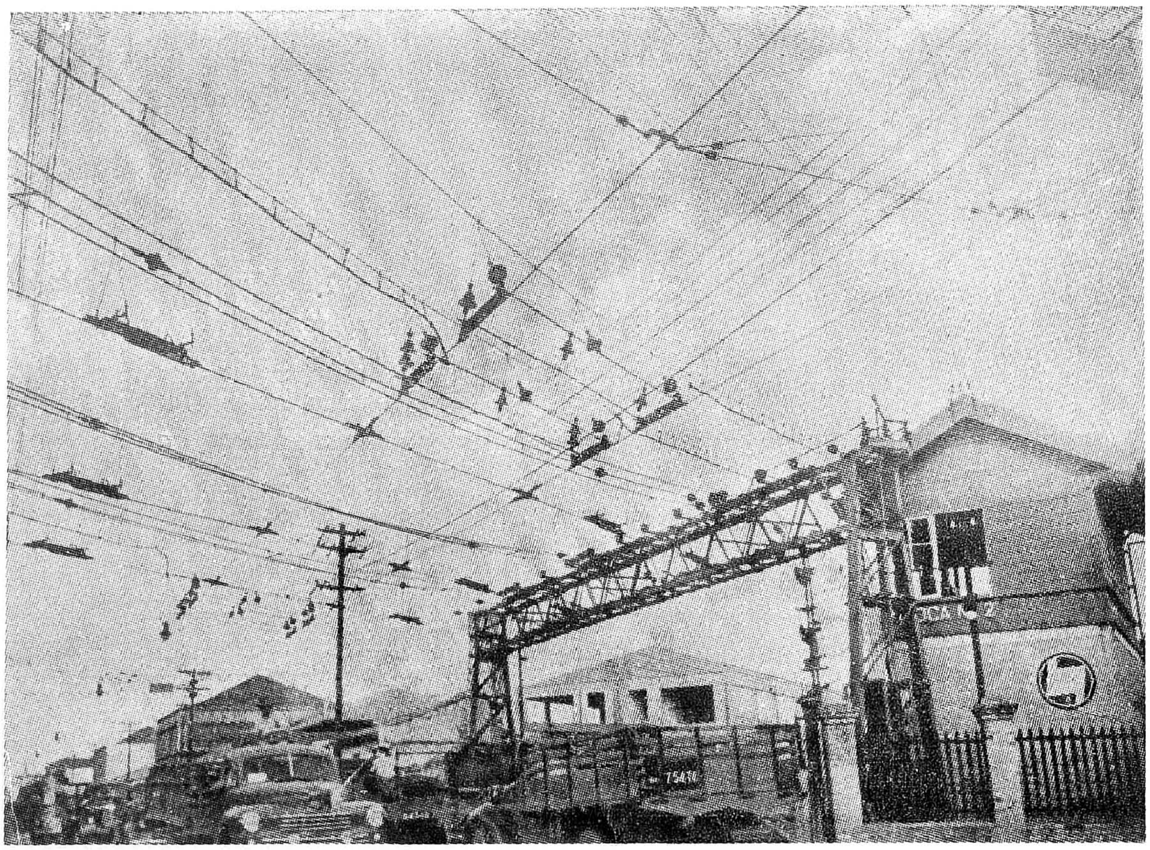
Simultaneously the 52 track miles of the main line between Bombay and Borivli were electrified. The reasons for this electrification, which has since been extended to Vihar, was the necessity for providing a quick means of transport for the growing population; recent figures indicate that the number of suburban passengers rose from 42 million in 1938 to nearly 135 million in 1948.

In 1934, 163 track miles of the Warsaw suburban system, Polish State Railways, were electrified. This scheme was notable in view of the wide temperature range and ice loading conditions under which the overhead equipment had to operate. For this reason the catenary and contact wires were automatically tensioned using balance weights and supported on swinging cantilever structures.

BICC has undertaken two major schemes in Brazil where a total of 380 track miles of the Estrada de Ferro Central and the Estrada de Ferro Santos a Jundiai were electrified. The former, officially opened in 1938, served the densely populated area of Rio de Janeiro where electrification was adopted to increase the carrying capacity of the line to deal with the rapidly increasing passenger traffic. The development of hydro-electric power in Brazil combined with the scarcity of local fuel supplies and the high cost of imported fuel naturally led to the conversion from steam to electricity as the motive power in the latter case. This scheme from Jundiai to Maua runs through the richest coffee growing area in the world and serves the heavy suburban traffic around Sao Paulo. A rather unusual problem was presented by a tramway crossing at Mooca. Here a system was



Erecting the contact wire using specially modified flat roofed coaches.—Manchester to Sheffield & wath Electrification.



The overhead equipment at Mooca level crossing showing the arrangement designed to permit tramcars to operate across the electrified tracks. The central section containing the actual points of crossing of the overhead wires is electrically separated from both tramway and railway equipments but may be energised at 600 volts or 3000 volts according to whether the crossing is open to tramcars or trains.—E. F. S. J. Railway Brazil.

devised to enable inter-running of both railway and tramway services on the overhead equipment at the crossing, whereby the contact wires were energised at 3,000 volts or 600 volts according to whether the crossing was open to trains or tram cars. A photograph of this equipment is included with the illustrations. As part of both railway projects high voltage power lines and low voltage signal feeder lines were also supplied and erected on extensions to the track structures. In Britain there are many miles of electrified railway using the third rail conductor principle. This has many disadvantages including limitation of conductor voltage, faults in bad weather and obstruction to track maintenance. There exhaustive reports in the past twenty years have concluded that the most suitable and economical method of electrification for this country is the overhead catenary system and this form of construction is to be adopted for all major schemes in the future.

Between 1929 and 1931 BICC converted the Manchester-Altrincham suburban line to electric operation. This line, which was the first in the country to be electrified using the 1500 volt overhead system, included a $1\frac{3}{4}$ mile section carried on a viaduct with curves and a gradient of 1 in 100.

In 1938 work commenced on the electrification of the London to Shenfield and the Manchester to Sheffield and Wath Lines. Work was stopped during the war years but both routes are now operating electrically and the former scheme is being extended to Southend and Chelmsford. Reference to the great increases in passenger traffic resulting from these schemes has already been made but perhaps even more remarkable are the freight results achieved on the Manchester-Sheffield-Wath project where the haulage of heavy mineral traffic over the Pennine Mountains has been so speeded up that the running time in some cases has been more than halved. On the formidable 1 in 40 gradients of the Wath bank to electric locomotives now haul heavier loads at double the speed of the four steam locomotives previously used while locomotives on the downhill journey with empty stock return power to the line by regenerative braking. Work is now proceeding on the electrification of the main lines between Sydney and Lithgow in New South Wales, Australia. This project across the Blue Mountains, reaching a height of 3700 ft., comprises 240 track miles and the first section has recently been put into service.

We have seen how the cleanliness and speed of electric travel is appreciated by the general public and railway staff alike, while the overall saving and economy in fuel made possible are points of national importance. The Weir Report of 1931 gave the conclusion that in Britain alone the electrification of all main lines would result in a reduction in coal consumption by 72% and in the cost of locomotive maintenance by 57%. Such trends are not unique but have been the experience wherever existing lines have been electrified.

BICC, the largest single organisation in the world with facilities for the design, manufacture, supply and installation of material for the complete overhead system, is proud to have been associated with the many schemes outlined herein. Its resources include well equipped factories backed by first class research facilities and a field force of widely experienced engineers. The Group is foremost in the field of new developments including the provision for British Railways of overhead equipment for an experimental high voltage section using alternating current at the industrial frequency. In addition experimental sites have been built where the characteristics of various forms of overhead construction are continuously recorded by instruments and conductor endurance and foundation tests are carried out.

The results of these and many other similar investigations will be taken into account in BICC's designs for the future and will enable the Group to maintain and improve its reputation for high quality equipment which meets the requirements of Railway Engineers in every land. *(By courtesy The Indian Railways Workshop Magazine)*

THIRD CLASS SLEEPING ACCOMMODATION

The facility of reserved sleeping accommodation has now been introduced on 13 Down/14 Up Bombay–Madras bi-weekly Janata Express trains. The procedure for the reservation of third class sleeping accommodation, which is at present provided on certain trains, has now been relaxed. Reservation of berths will commence 10 days in advance, instead of three days in advance as at present. At the starting stations, reservations can be made upto the time of the starting of the train. The practice hitherto was to stop reservation six hours prior to the departure of the train. Reservations from intermediate stations will be made on a basis of priority, at the starting stations. However, at intermediate stations it will be necessary to stop reservations 24 hours prior to the time of the departure of the train from the starting stations.

Urgent Need for Development of Indian Shipping

THE development of Indian Shipping has been given a very high priority by the Government of India, as it is an essential prerequisite for the promotion of trade and commerce of the country. For India to be largely self-sufficient in shipping and the carriage of a substantial volume of her export and import trade in bottoms owned by her own nationals, will require a tremendous effort and in fact it can only be a very long-ranged policy, one requiring enormous capital investment and very specialized organisation. But as a step towards achieving this ideal, the Government of India had appointed a Study Group composed of representatives of shipping interests to examine the target of expansion during the Second Five-Year Plan. The report of the Study Group has since been received and is now under consideration by the Planning Commission.

The target envisaged is a net addition of 72 ships totalling 4.45 lakh tons gross of shipping at an estimated outlay of Rs. 80 crores, the private sector contributing Rs. 10 crores and the balance being advanced by Government. The target for shipping expansion envisaged in the First Five-Year Plan was six lakh tons gross and for this purpose the Plan provided a total sum of Rs. 23.2 crores by way of loans to shipping companies and investment in the Eastern Shipping Corporation. Out of this sum, actual disbursements and firm commitments by way of loans up-to-date amount to about Rs. 20 crores and it seems quite probable that the balance amount will also be taken up before long. The Indian tonnage at present is about 4.7 lakh tons. Indian Shipping Companies have already on order in India and abroad, a total tonnage of about 98,000 tons and further orders and purchases to the extent of 33 to 40 thousand tons are expected to materialize during the current financial year.

There is thus every likelihood of India achieving the First Five-year Plan target of 6 lakh tons of Indian-owned Shipping. If recent progress and the future programmes are an indication, there seems every chance of the target being even exceeded slightly. With tonnage nearing the 5-lakh mark, Indian ships now carry all the coastal trade, a fair volume of the adjacent trade and a small share of the Overseas Trade.

OVERSEAS TRADE

To make up our deficiencies in the overseas trade, the Government have assured shipowners that they would help secure a fair share of Government cargoes procured from overseas, if only the companies would acquire the necessary ships. In the matter of acquisition of tonnage by these companies the Government have offered loans on generous terms; sanction during last year being over Rs. 8 crores.

The Government is also trying to secure the participation of some private companies in the establishment of a second Shipping Corporation with headquarters at Calcutta. The formation of this Corporation will give an impetus to the expansion of tonnage as well as overseas trade in India bottoms. It is expected that after the end of the First Five-Year Plan period our overseas tonnage will stand at 280,000 tons. The Second Five-Year Plan envisages a net addition of 37 ships totalling 270,000 tons gross to this fleet.

Apart from giving loans at a concessional rate of interest for the acquisition of new fast ships, Government also render assistance by sponsoring the companies for admission to the various conferences, by helping them to secure a reasonable share of cargoes owned and controlled by Government and by providing suitable clauses in trade agreements with foreign countries to ensure that a proportion of cargo arising out of such agreements move in Indian bottoms.

NOTEWORTHY PROGRESS

If it is remembered that Indian Shipping Companies have been operating in the overseas field for only about seven years, the achievement of these companies in gaining a stable footing in some of the important overseas routes is noteworthy. The resourcefulness displayed by two of our Indian Companies in maintaining their services on the India/U.K./Continent trade have recently received recognition by their admission with unrestricted rights to full membership of the various Conferences concerned. Another Indian Shipping Company has found it possible as the result of friendly negotiations to enter the Indian-Persian Gulf trade on a liner basis, and one of our younger companies has entered the overseas trade on a tramp basis. Thus our Indian Companies, it is expected, will not only be able to give more regular and faster services on existing routes but also expand the area and scope of their activities.

COASTAL TRADE

A target of 400,000 tons gross for the coastal trade and another 50,000 tons for the adjacent trades during the next Five-Year Plan as against the present tonnage of approximately 250,000/300,000 tons gross has been

envisaged. For a successful and economic utilization of such large additions to the tonnage on the coast, proper co-ordination between the Railway and coastal shipping is very necessary. The Government have therefore appointed a Committee to go into all aspects connected with rail-sea co-ordination.

TANKER TRADE

The Government have decided to acquire and operate two tankers of 8,500 tons each which will form the necleus of a tanker fleet. Specification for the vessels to be acquired are about to be finalized and it is hoped that orders for these vessels will be placed before long. Government are also examining the possibility in consultation and by arrangement with the Oil Companies of employing on the oil trade a few tankers owned and operated by Indian Companies who may be interested in such a proposition.

PORTS

The post-war needs of shipping call for the rehabilitation and modernization of Port facilities. A major port with an optimum capacity of 1.25 million tons is being constructed at a Kandla in Kutch and the harbour works are likely to be completed by April 1957 at a cost of about Rs. 14 crores.

The Major Port authorities of Bombay, Calcutta, Madras, Cochin and Visakhapatnam have taken up for execution, development schemes designed to enable them to handle the existing traffic more efficiently. The overall expenditure on these schemes is of the order of Rs. 45 crores of which over Rs. 25 crores would be incurred during the First Five-Year Plan period. The remaining items of work as well as fresh schemes of port development will be taken up in the period of the Second Five-Year Plan. An agreed programme of development of the more important of the minor ports in the country costing about Rs. 2.5. crores is also being implemented in the period of the First Five-Year Plan with a view to equipping these ports for the efficient handling of the cargo and passenger traffic passing through them. Side by side with the extention of this programme to cover other minor ports, the feasibility of development of Tuticorin, Mangalore or Malpe in Madras and Paradip in Orissa is expected to be taken up for examination during the Second Five-Year Plan.

MALAYA ORDERS 20 BRITISH DIESEL-ELECTRIC LOCOS

The Malayan Railway has ordered 20 main-line Diesel-electric locomotives from a British firm (the English Electric Co.). The contract is valued at around £1,500,000.

These locomotives, each weighing 96 tons, will be used to haul express trains up to 450 tons in weight on the Singapore-Kuala Lumpur-prai line.

With these new engine the Malayan Railway is planning extensive improvements in its main-line services. Operating speed at the moment is limited to 45 m. p. h., but with the new Diesel-electrics a maximum speed of 60 m. p. h. will be possible.

Earlier this year, English Electric received a £ 800,000 order from the Indian Railway Board for 12 electric locomotives, each weighing 111 tons.

These 3,000-volt locomotives are generally similar to the seven English Electric engines which went into service earlier this year on the Central Railway. The 12 additional electric locomotives will be employed on the Howrah-Burdwan section of the Eastern Railway, where the Railway Board has planned very extensive electrification. They will be the first 3,000-volt electric locomotives to operate in India.

* * *

SURVEYS FOR SIX NEW LINES ORDERED

Surveys for six new lines totalling 603 miles in length have been sanctioned by the Railway Board one of which is to be conducted by the Central Railway.

The Central Railway will do a preliminary engineering survey for a broad gauge railway line between Gwalior and Ujjain *via* Shivpuri, Guna and Agar, a distance of 286 miles. The survey will also be carried out for the alternative alignment *via* Shahjapur and Maksi, which will be distance of 260 miles.

The proposed line will provide a direct link between Gwalior and Ujjain and also to Indore when the Indore-Ujjain line is constructed. It is expected to help in the rapid development of agriculture in Industry in this fertile region of Madhya Bharat.

BRITAIN'S ROLLING STOCK BUILDERS

MESSRS. Charles Roberts & Co. Ltd., of Wakefield, Yorkshire, are to-day one of the largest builders of railway rolling stock in Great Britain, and export their vehicles to all parts of the World.

The first British railway from Stockton to Darlington was opened in 1825, and in the following 30 years many new railway lines were opened. In 1856 one Mr. Charles Roberts, then working as a wagon builder opened a small business in the town of Wakefield for the construction of railway wagons on his own account.

At that time such vehicles were built almost entirely of wood and were of comparatively small capacity. The works had no direct siding connection with the railway line, and when the vehicles were built they were taken on a horse-drawn cart to the railway station and there mounted on their wheels on the railway lines.

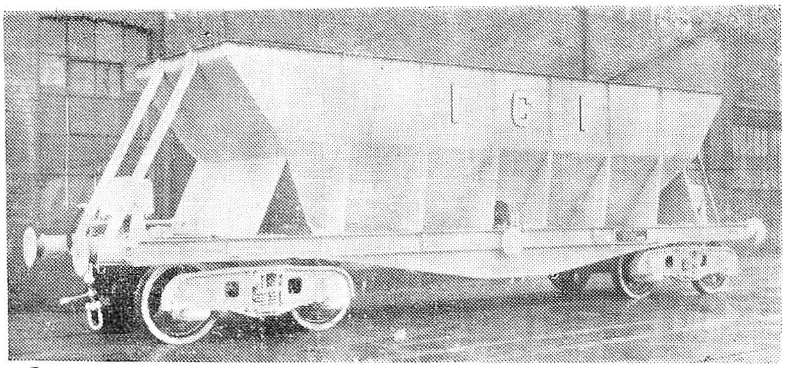
The undertaking made slow but satisfactory progress and in 1873 it was decided to form a Limited Company to take over the works and assets of Mr. Charles Roberts, he being the first Managing Director, and a new site was acquired about three miles outside the town at Horbury Junction, where there was direct access to the main line and ample room for expansion.

The Company's business was still confined to local Collieries, and the output by to-day's standards was very small, but progress was continually made and in 1899, when the present Chairman, Mr. Duncan Bailey, O. B. E., M. I. Mech. E., joined the Company as a young man, they were employing about 200 workmen but were still only building wooden wagons for local Collieries, and all components such as wheels and axles, springs and axleboxes, were purchased from outside makers. A connection was being slowly built up for the supply of railway tank wagons.

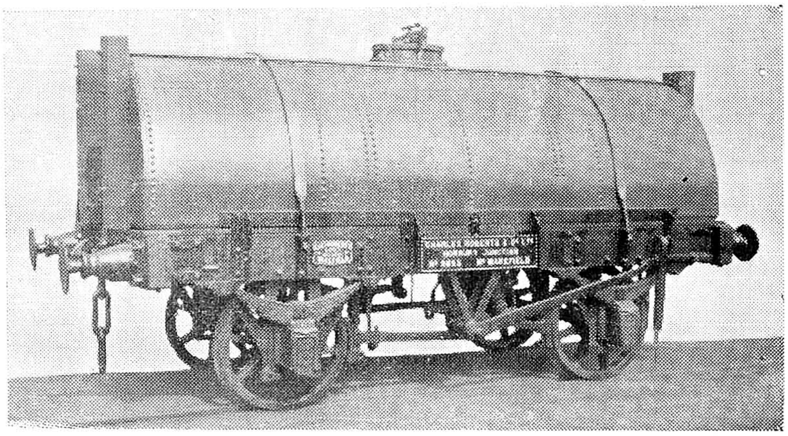
From this time onwards progress was much more rapid. In 1904 a new shop and equipment was installed for the production of wheels and axles, which, at that time, were entirely of the spoke type.

A few years later plant for generating electricity was installed, replacing the old belt drives from reciprocating steam engines, the steam being generated by Cahall type vertical water tube waste heat boilers utilising the surplus heat from the forge furnaces.

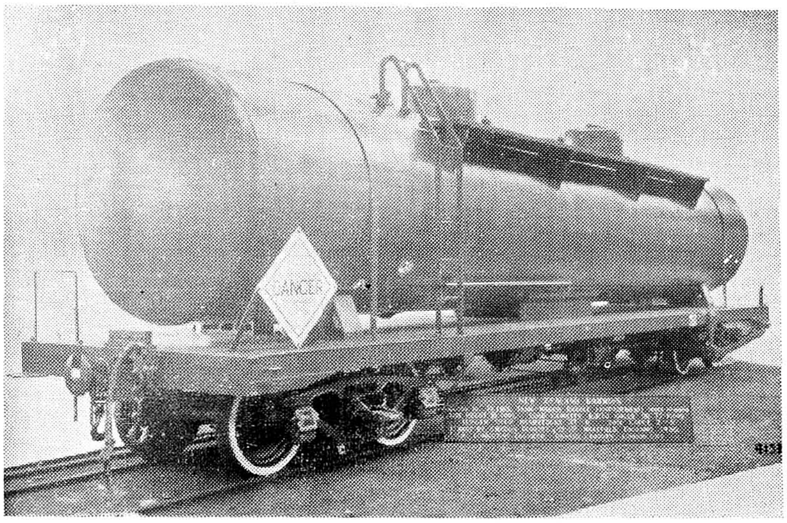
The next development was in 1910 when a Brass Foundry was installed, although, with its melting pots in the floor using small crucibles, it bore little



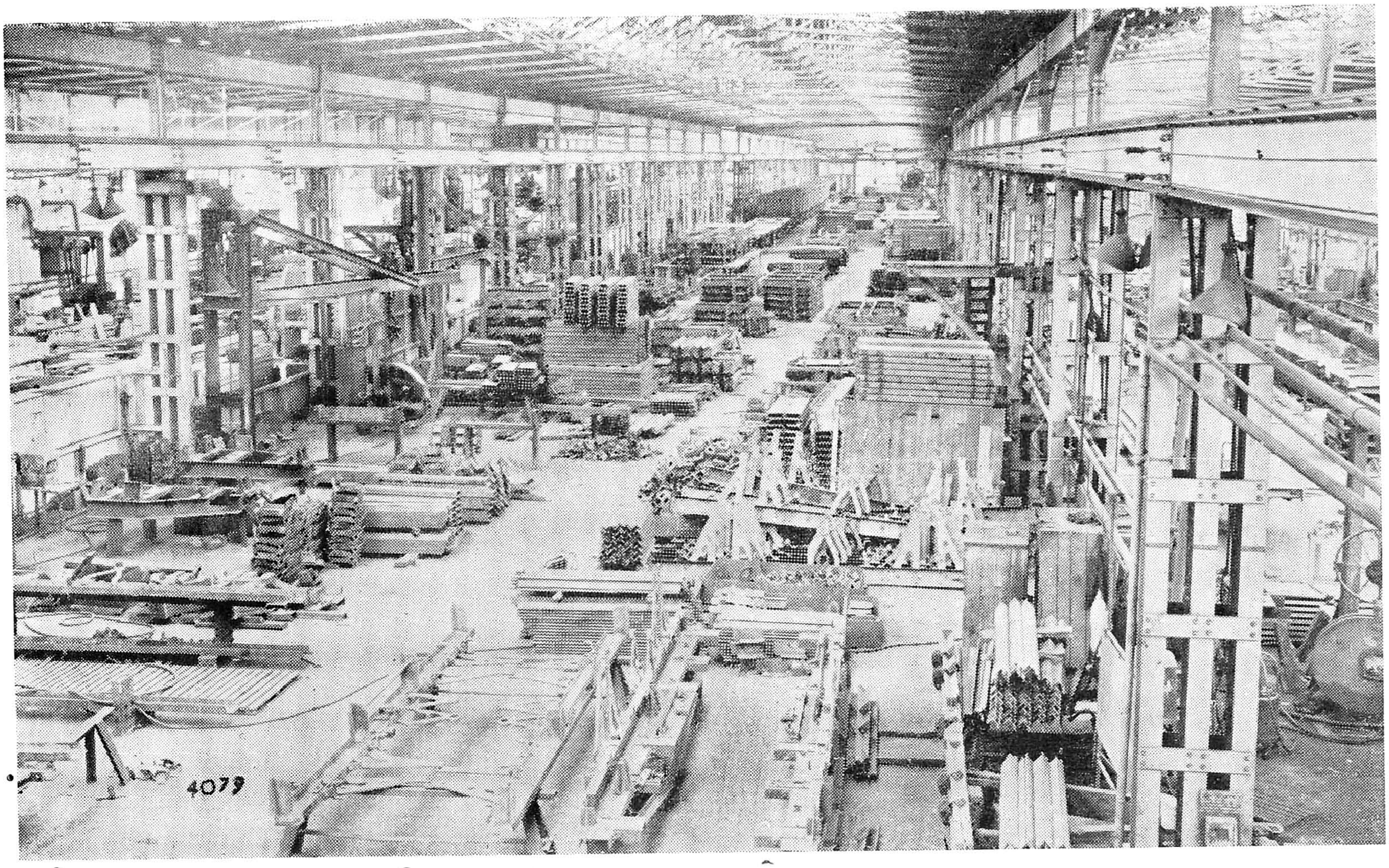
$44\frac{1}{2}$ Ton Bogie Hopper Limestone Wagon for Fast Freight Traffic Standard Gauge.



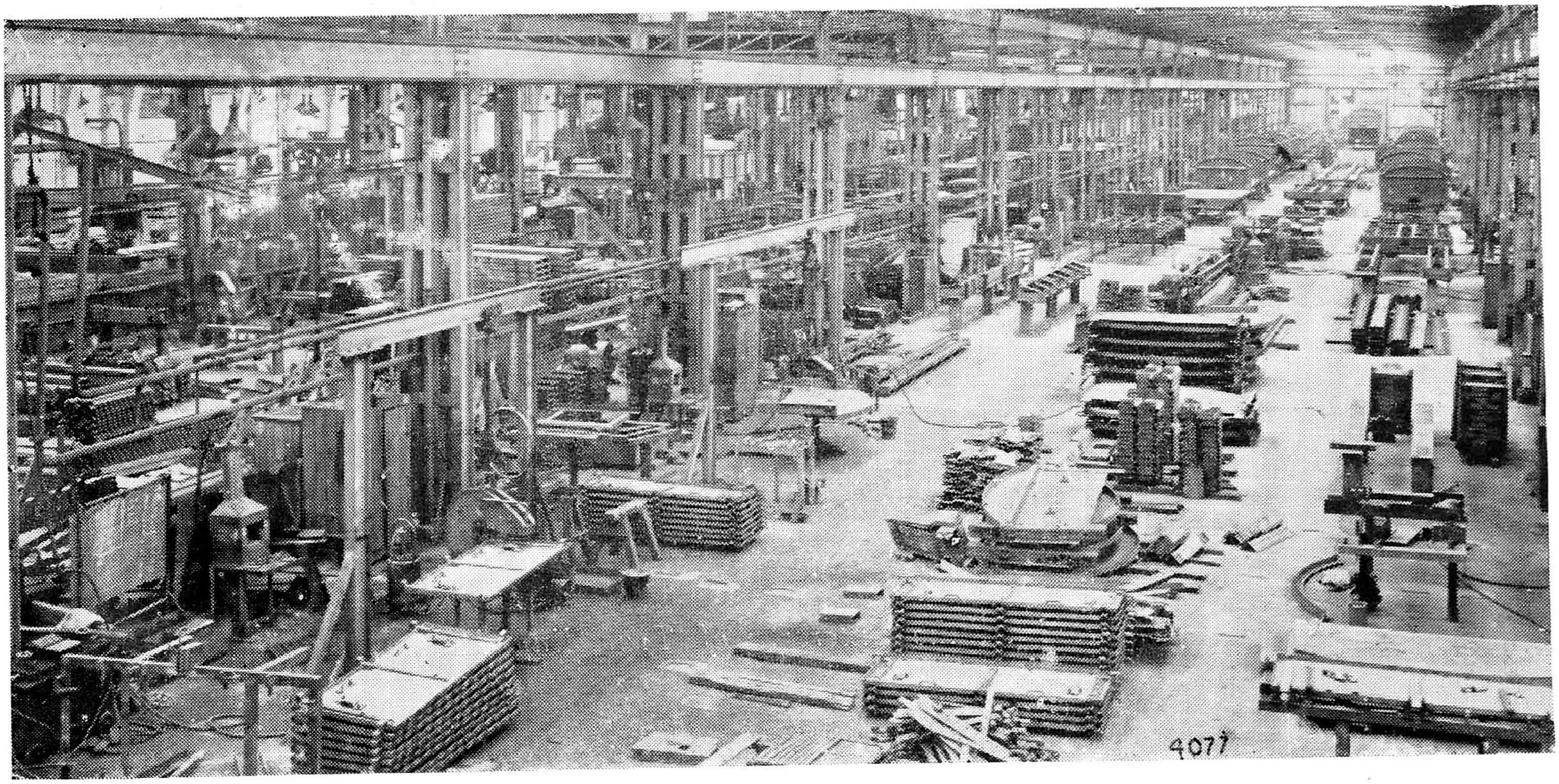
Early type railway tank wagon built in 1881 Standard Gauge.



22 Ton Petrol Tank Wagon for New Zealand Railways 3'-6" Gauge.



Underframe Shop — Detail Bay.



Underframe Shop — Assembly Bay.

IN YOUR OWN INTERESTS

HOW TO PURCHASE TICKETS

Buy your tickets only at the proper place. The authorised offices are (i) the Booking offices at the railway stations, (ii) the Town or City Booking Offices, (iii) the out-Agencies, (iv) Travel Agents. Never buy tickets from any other source as that may lead you to trouble. Please note that tickets are not transferable.

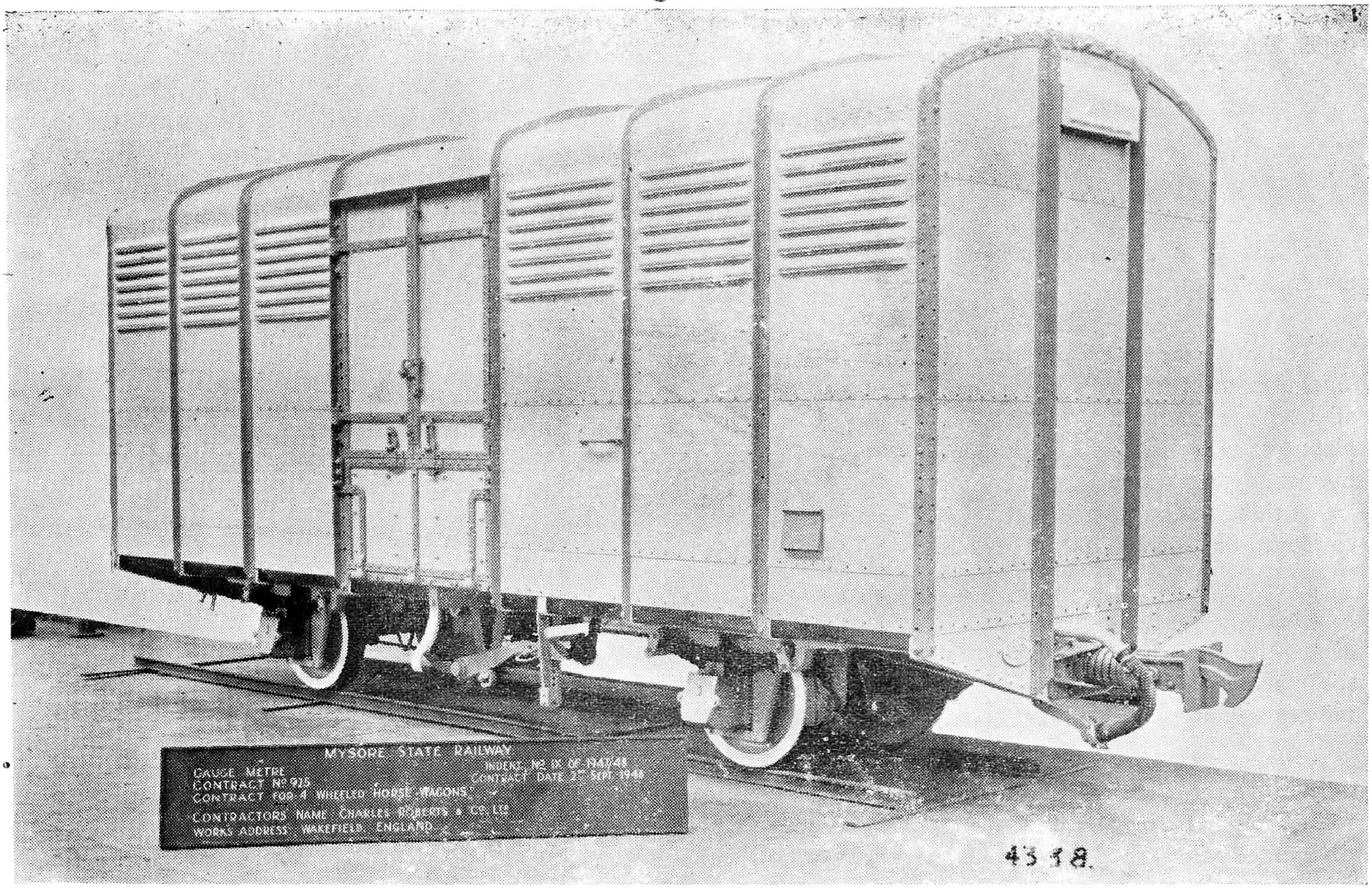
Buy your tickets in the proper time. You can avoid unnecessary excitement and trouble if you come to the station in good time, that is at least half an hour before the scheduled departure of your train. The Time Tables of the Railway are on sale at Booking Offices and Bookstalls.

Buy your tickets in the proper manner. Queue up at the Booking Window and you can get your ticket easier and quicker than by crowding at the counter.

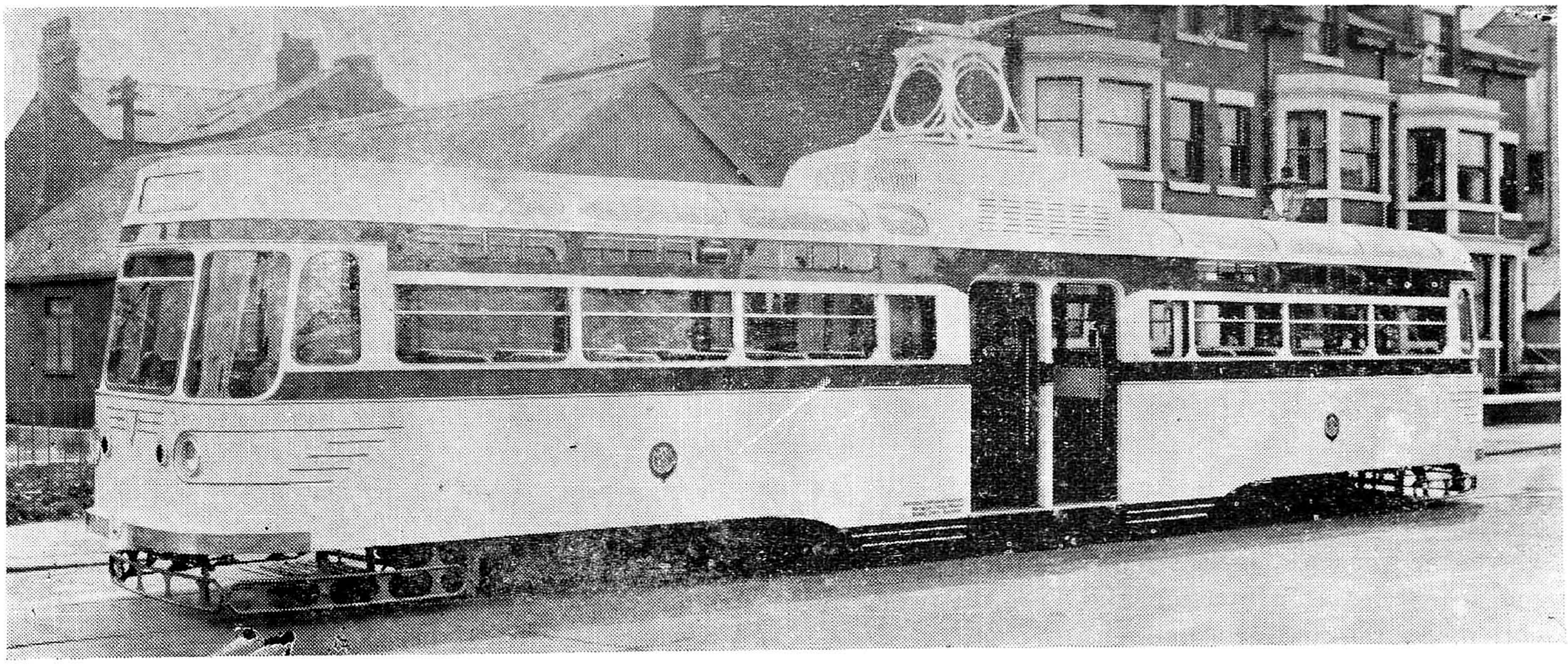
By handing in the *exact fare in good coins or currency* you get the ticket easier and quicker, and save for yourself and the Booking Clerk time and trouble.

Check up your ticket and money before leaving the counter and draw the attention of the Booking Clerk to any discrepancy you may notice.

(Inserted in the interests of Travelling Public)



4 Wheeled Horse Wagon for the Mysore State Railways — Metre Gauge.



Light Rail Car for Inter-Urban Traffic — Standard Gauge.

resemblance to the present modern Brass Foundry to which reference will be made later.

In 1913 a new building was erected and equipped as an Iron Foundry for the production of axleboxes and other cast iron components such as brake blocks, etc.

At this time the works covered an area of approximately 20 acres.

Then came the first world war, when the Company's chief armament production was the 18 lb. shrapnel shell, of which 1¾ millions were made. The existing forge plant was used mainly for the production of the forgings, but a new shop was built and equipped for the machining of these shells. By this time the number of men employed had increased to about 800.

When the war was over the shell machining plant was dismantled and the Company installed a new plant for the manufacture of all types of springs required on railway wagons, both laminated and coil.

In 1925 the premises of an adjoining bar and plate rolling mill were acquired and although the plant was dismantled this gave a very valuable and much needed addition to the shop space available.

At the same time two bays of an entirely new shop for the construction of all-steel wagons were erected, and the Company began slowly to develop an export trade.

In 1931 the Company built certain new shops and equipped some existing shops for the production of passenger-carrying road vehicle bodies. This department has been carried on as a separate section from the railway wagon building side and has developed and progressed until, at the present time, the Company are in an excellent position to undertake the construction of all types of railway carriages. To cope with this demand the production of motor 'buses has ceased, and they confine their activities to the building of railway carriages and light self-propelled electric rolling stock.

From this time onwards development proceeded at a constantly accelerated pace. The old low-roofed shops where the wooden wagons were built were demolished and the steel wagon erecting shops greatly extended, until to-day the erecting shops consist of four bays, each approximately 50 feet wide by 900 feet long.

A separate department was equipped for the production of all types of railway tank wagon barrels. This type of vehicle has been a special feature of the Company's production and they are quite the largest builders of these in Great Britain to-day. It is a special section of railway wagon building and presents many peculiar problems, of which the Company now have great experience.

The old Brass Foundry has been replaced with a modern up-to-date foundry with the very latest equipment both in the way of moulding machines and a tilting-hearth continuous melting furnace.

The Iron Foundry has been completely modernised and is now semi-mechanised, with sand delivery to the various moulding machines by overhead belt, and return-sand-belting from the knock-out points.

The Forge has been equipped with a centralised pulverised coal plant capable of grinding and firing in the various furnaces a total of one ton of coal per hour.

Great strides have been made to deal with the increasing utilisation of all types of electric welding, and this has included the provision of the latest types of flash-butt welding plant in addition to the normal hand-welding technique.

No attempt was made to generate electric power in the Works, the whole of this being taken from the National grid system, the power factor being very carefully corrected with one of the latest fully automatic power-factor-correction equipments, involving the use of static condensers at various strategic points.

To-day the works cover an area of 45 acres and produce therein practically all the components that are necessary to enable them to send out the finished rolling stock.

Although, during the last year or so, a National shortage of steel has hampered output to some extent, nevertheless the Company last year produced goods to the value of approximately two million pounds Sterling, and with the fortunate indications that supplies of steel will be much better during the next twelve months, there is no doubt that, backed by a full order book for many parts of the World, that output will be substantially exceeded in the future.

The Company's motto "The memory of quality remains when the price has been forgotten" has served them and their customers well for nearly 100 years.

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STEEL WAGONS

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RAILWAY EQUIPMENT COMMITTEE MEETS AT NEW DELHI

A 6-day session of the Railway Equipment Committee, under the chairmanship of Shri G. B. Kotak, commenced in New Delhi on 22nd August, 1955, with discussions with representatives of the National Chamber of Industries and Commerce, Agra.

The Committee has already held meetings at other important centres in the country like Bombay, Madras and Calcutta.

Throughout the current week the Committee will have meetings with representatives of engineering firms with headquarters in various parts of the country. The Committee will also have discussions with the Chief Designer of the Railways' Central Standards Office, the Director of Railway Equipment of the Railway Board, Director-General of Supplies and Disposals and representatives of the Northern Railway Administration.

At the Committee's instance four show rooms have been opened at Delhi, Bombay, Madras and Calcutta where items of Railway equipment not at present manufactured in the country are exhibited.

The Committee has been charged with the task of discovering indigenous capacity within the country for making the Railways self-sufficient in regard to Railway equipment.

NEW RESTAURANT CARS AND DINING CARS FOR INDIAN RAILWAYS

New restaurant cars and dining cars for use on the Indian Railways are to be built immediately according to revised modern designs prepared by the Indian Railways Central Standards Organisation. Within the next few months the first of these redesigned cars is expected to come into service, and thereafter a steady supply will be kept up.

The restaurant cars will be used for catering mainly in the Western style on all important long-distance mail and express trains carrying upper class and tourist traffic. The dining cars will cater in Indian style.

A common feature of the two types of cars will be greater sitting comfort for passengers. In large airy kitchens there will be arrangements for vegetarian and non-vegetarian food to be cooked separately. Special attention has been paid to cleanliness and hygienic surroundings and arrangements for quick and efficient service. There will be accommodation in these cars also for the Manager, his staff and stores.

The new restaurant and dining cars will be built both for broad gauge and metre gauge trains.

The dining cars will be fitted with large refrigerators, exhaust fans to keep the air cool, folding tables and manoeuvrable chairs and devices for keeping the dust out.

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Clean orderly habits contribute to general health and welfare and as such to happiness and prosperity; they are more important than medicines.

Cleanliness prevents disease; medicine only attempts to cure.

Cleanliness of the person, of the houses and colonies, reflects discipline in the individual and the community. Discipline is the foundation stone for progress of oneself and the country. Cleanliness is a good habit. It is also cheap.

All Railwaymen should set an example of cleanliness. This will help others and themselves.

Printed and Published by Sri T. S. S. Rao, Public Relations Officer at S. R. Press for the "Southern Railways Magazine", Manojiappa Street, Fort, Tanjore.
Managing Editor : T. S. Krishna Rao.